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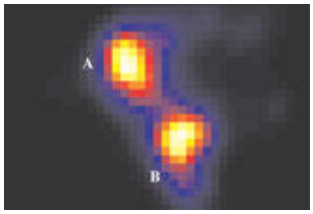

Black Holes Blow Matter into Space with Tremendous Wind, Study Finds

By Robert Roy Britt
Senior Science Writer
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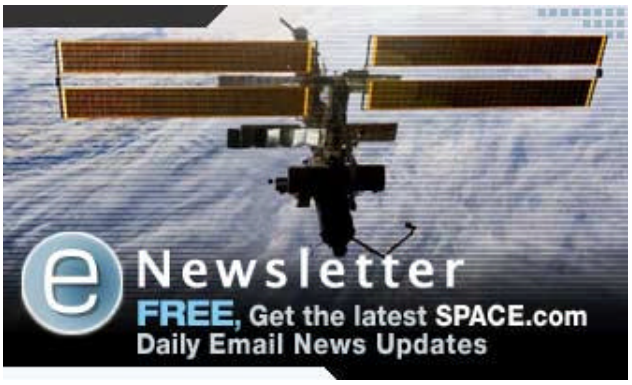

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Astronomers know that black holes spit energy back into space as they voraciously consume matter in a process that is not entirely efficient. Now it seems they propel matter outward, too, in a wind to end all winds.

Theory had predicted the fast-moving exodus of stuff, but no one had ever seen it happening. A new study found evidence of hydrogen, carbon, oxygen and iron rushing out from the vicinities of two separate black holes in winds of material moving at some 40 percent the speed of light, faster than astronomers expected.

The black holes are supermassive, weighing as much as millions or billions of regular stars and anchoring two distant, bright and fledgling galaxies called quasars. Quasars are thought to be surrounded by vast reservoirs of gas, which tends to move toward the center and fuel star birth while also feeding the black hole. The chaos leads to intensely bright objects which, astronomers believe, settle down and become conventional galaxies over time.

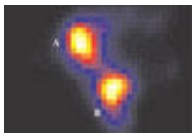
"The winds we measured imply that as much as a billion suns' worth of material is blown away over the course of a quasar's lifetime," said Penn State's George Chartas, who led the observations.

The wind is created by differences in radiation pressure, Chartas and his colleagues said, somewhat like how differences in air pressure create wind on Earth.

The winds might help regulate black hole growth, thwarting other incoming material that is compelled to spiral inward at the request of the black hole's gravity, Chartas and his colleagues say. The outrushing wind might also spur the creation of new stars, by causing pressure and temperature knots in the overall gas cloud.

Observations were made with NASA's Chandra X-ray Observatory and the European Space Agency's XMM-Newton satellite and announced today at a meeting of the High Energy Astrophysics Division of the American Astronomical Society at Mt. Tremblant, Quebec.

Images



This quasar is at a distance of over 5 billion light years from Earth, a redshift of 3.91. This is an X-ray image captured by the orbiting Chandra X-ray Observatory. APM 08279+5255 is magnified naturally through gravitational lensing by a factor of about 100. This means that the quasars light, while en route to us, was distorted and magnified by the gravity of intervening galaxies acting like telescope lenses. CREDIT: NASA/CXC/G. Chartas et al.

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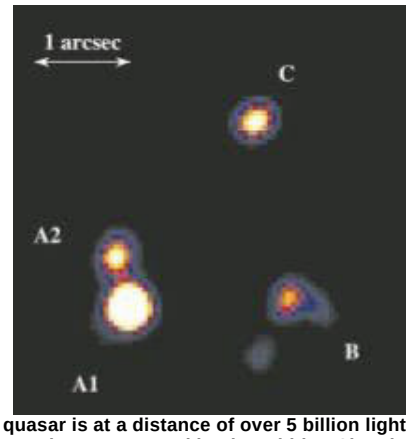

Quasar PG 1115+080: This quasar is at a distance of over 5 billion light years from Earth, a redshift of 1.72. This is an X-ray image captured by the orbiting Chandra X-ray Observatory.

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The winds originate in a disk of material spiraling inward. This accretion disk of gas and dust is accelerated to ever-faster speeds before some of the matter disappears beyond a sphere of no return, the so-called event horizon of a black hole. Astronomers already knew with relative certainty that the process can create two jets of energy that shoot out along the black hole's axis of rotation. Other radiation emanating from the scene in all directions has also been imaged.

But by spotting evidence of matter pushing outward, researchers think they're on a path toward better understanding of how galaxies and their central black holes evolve.

"The wind might provide insight to the relationship between black hole mass and the central bulge of its host galaxy," said Niel Brandt, a Penn State researcher also involved in the discovery.

Only recently have other research teams begun to weigh the black holes in the most distant quasars. Theory holds that the black holes should typically contain less than 1 percent of the mass of the overall galaxy.

The study examined quasars called APM 08279+5255 and PG1115+080. Both are billions of light-years away but were magnified as their light was distorted by the gravity of intervening galaxies. This natural process, called gravitational lensing, allows astronomers to see distant objects in greater detail.

Gordon Garmire of Penn State and Sarah Gallagher of MIT also worked on the study.

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